EFFICIENCY AND ENVIRONMENTAL PERFORMANCE OF IMTA IN MARINE AND FRESHWATER SYSTEMS

IMTA -EFFECT
Integrated Multi Trophic Aquaculture for Efficiency and Environmental Conservation

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Cooperation in Fisheries, Aquaculture and Seafood Processing

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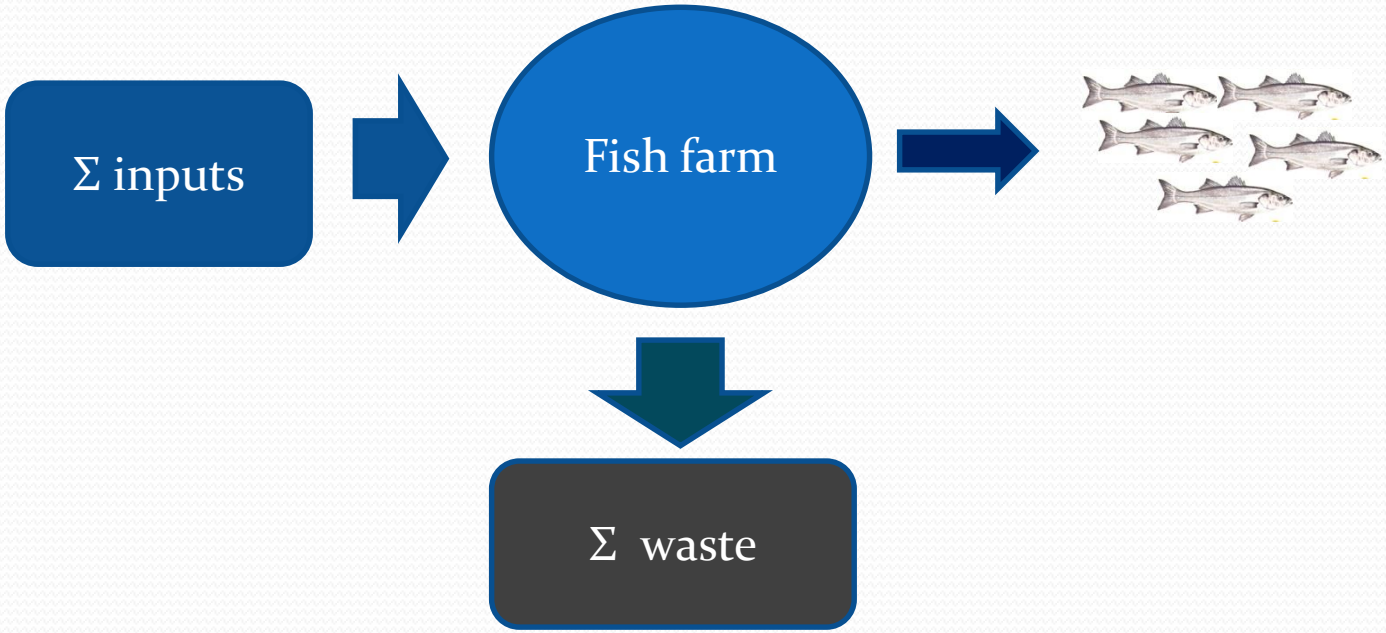
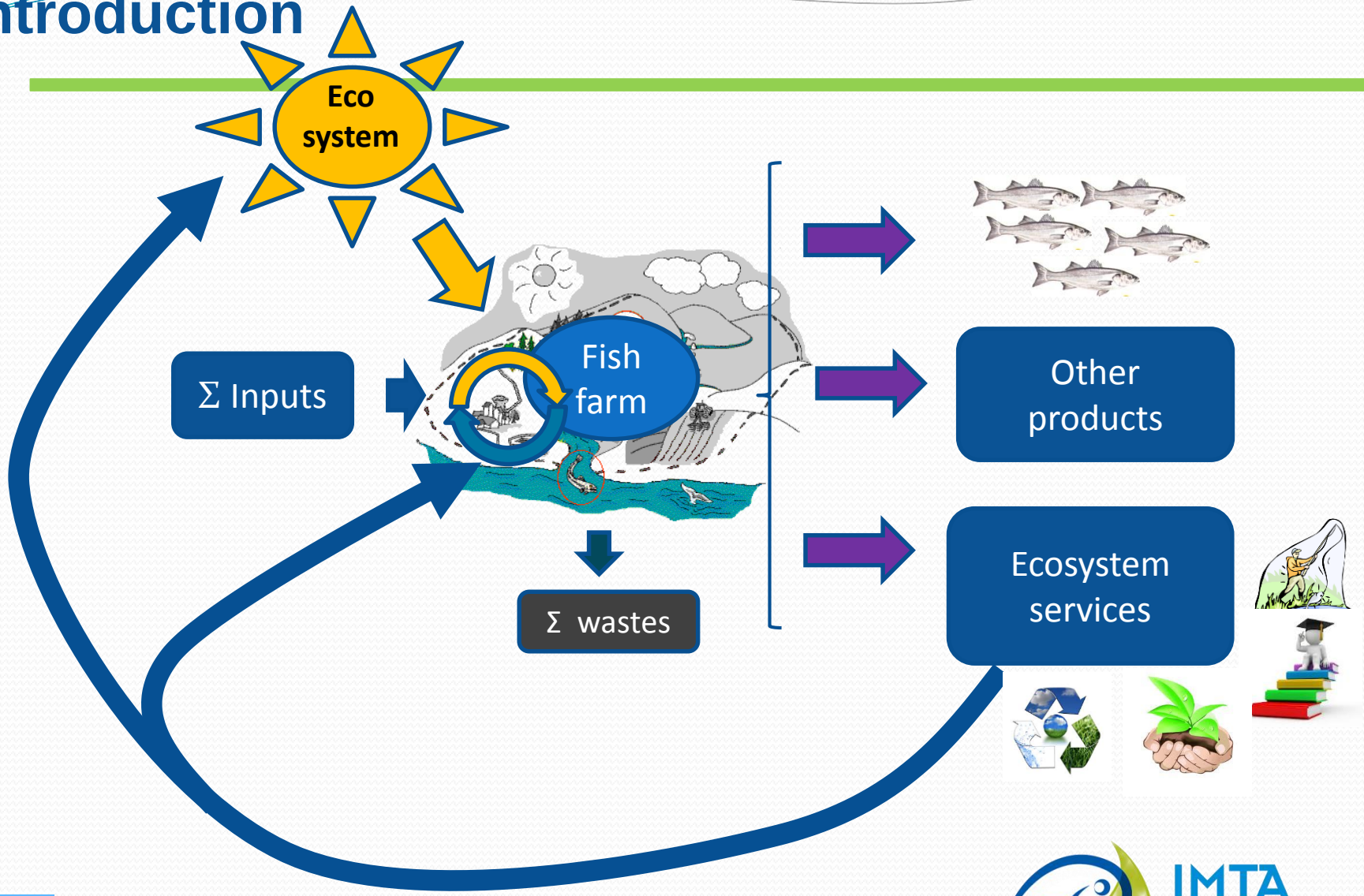
Introduction



Introduction



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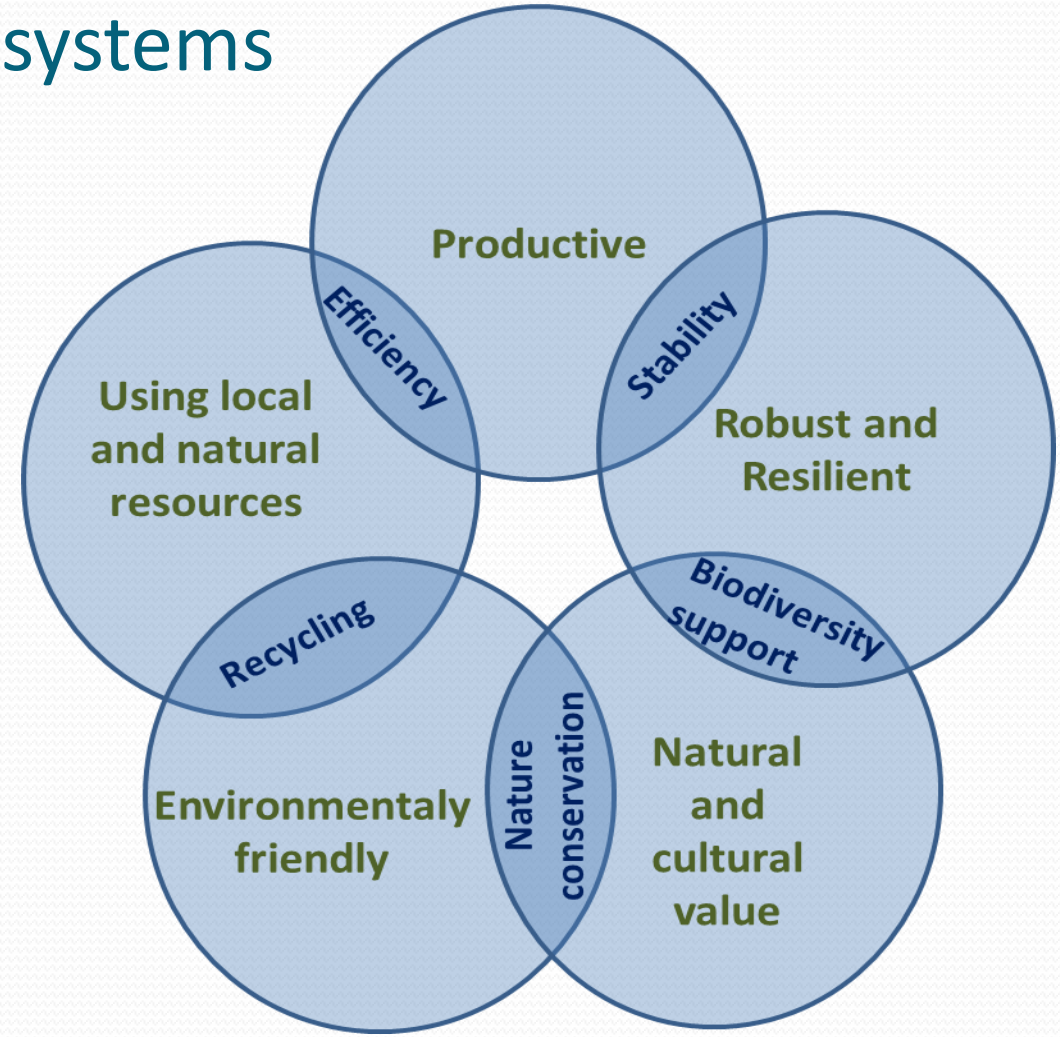
Ecological principles for aquaculture

In pond systems



Aubin et al., 2017

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Integrated Multitrophic Aquaculture

IMTA systems are designed in order to:

1. **Decrease** the dependence on **external inputs**
2. **Optimize the use of nutrients and energy** in the production loop, in order to increase the system **efficiency**
3. **Decrease the waste** effluent and bio-deposit impacts by limiting the loss of nutrients (in water, sediments and air)
4. **Diversify farm- products** and generate a more robust source of income (less dependent on mono-product markets)
5. Generate and use different types and levels of **ecosystem functions and services**

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Facing the complexity

- In IMTA relationship between species are multiple:
  - Trophic
  - Chemical
  - Behavioral
- The whole is greater than the sum of the parts
  - Optimizing the system is different from optimizing each part
- IMTA are still empirically built
- Social perception of IMTA are not well known

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There is a need for

- More descriptions / observations of IMTA
  - To collect references in different contexts
- Modelling developpments
  - To understand the system operation
  - To help design
- Global approaches
  - To assess the multiple performances
  - To identify the factors of implementation success

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IMTA Effect

Efficiency and environmental conservation

ERANET COFASP 2015

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IMTA Effect project

- Extention of IMTA to freshwater systems
- Understanding of the interactions of species of different trophic levels in IMTA,
- Provision of reliable practical references for system implementation
- A focus on the primary production, as it can be considered as:
  - the major trophic level in the capture of dissolved nutrient
  - the major functional component in the conversion of the CO_2 into O_2;
  - a source of food for the reared species, in a perspective of closed system approach (total recycling);
  - a source of income,

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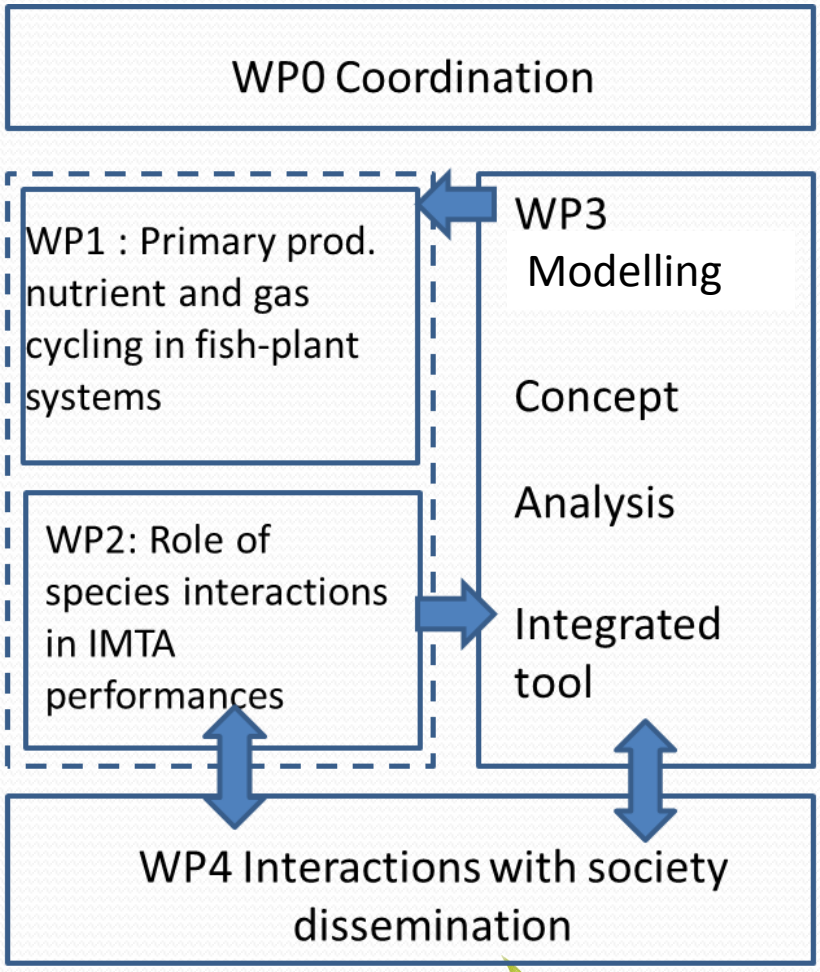
Organization

- Experimental approach aiming:
  - The assessment of the efficiency of different IMTA systems;
  - Nutrient and energy flows analyses (role of the different species in the food web, and the evaluation of the recycling efficiency) (WP1 & WP2).
- Modelling: to adapt and create specific tools for system running prediction connected with environmental analysis (WP3).
- Economic and social evaluation: to understand the perception of the IMTA by stakeholders through the ecological services framework (WP4).



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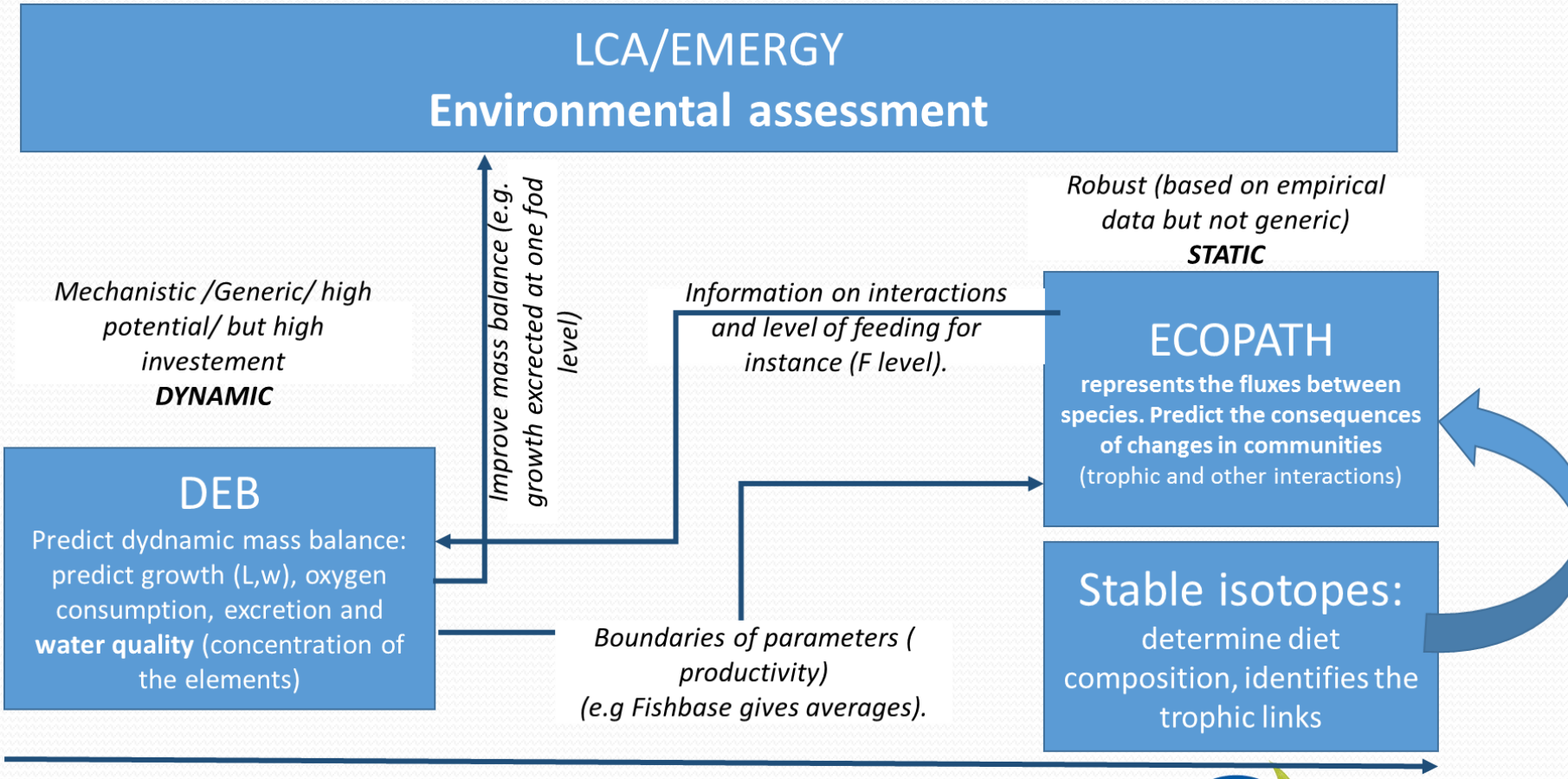
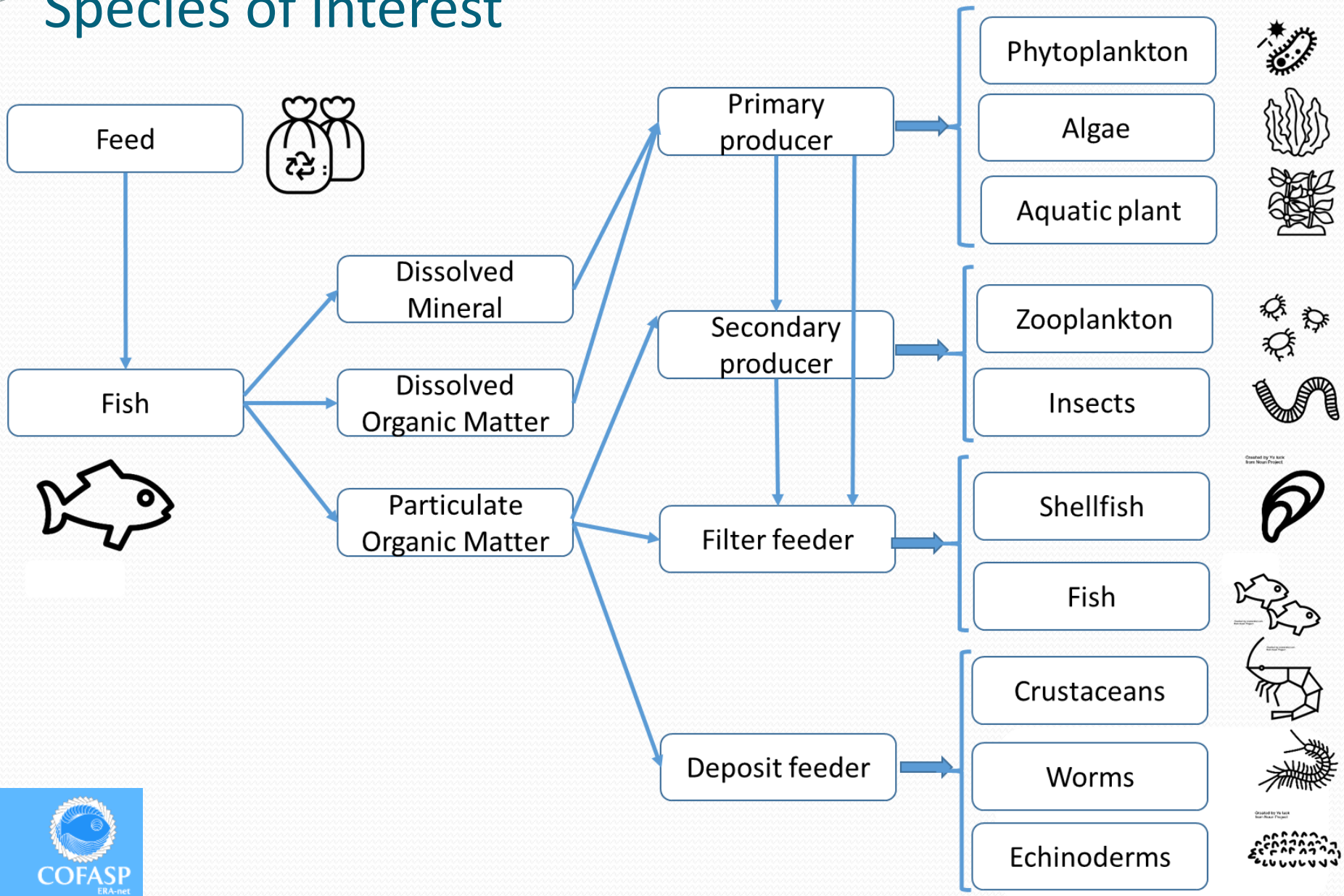
Modelling approaches



Simplified web

Species of interest



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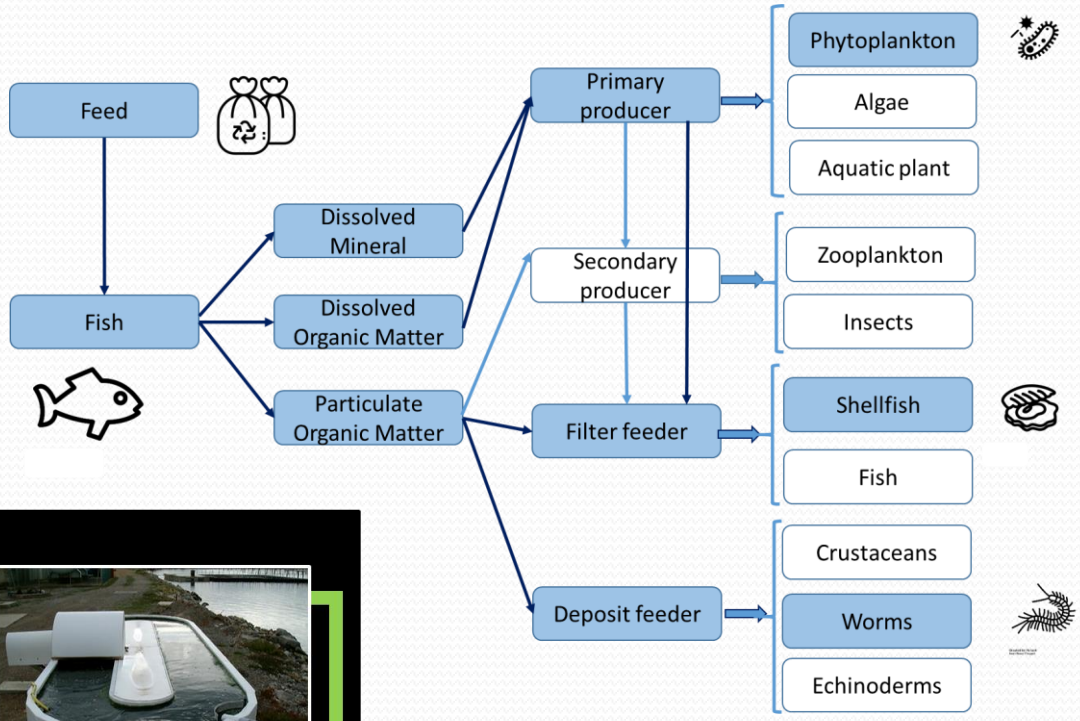
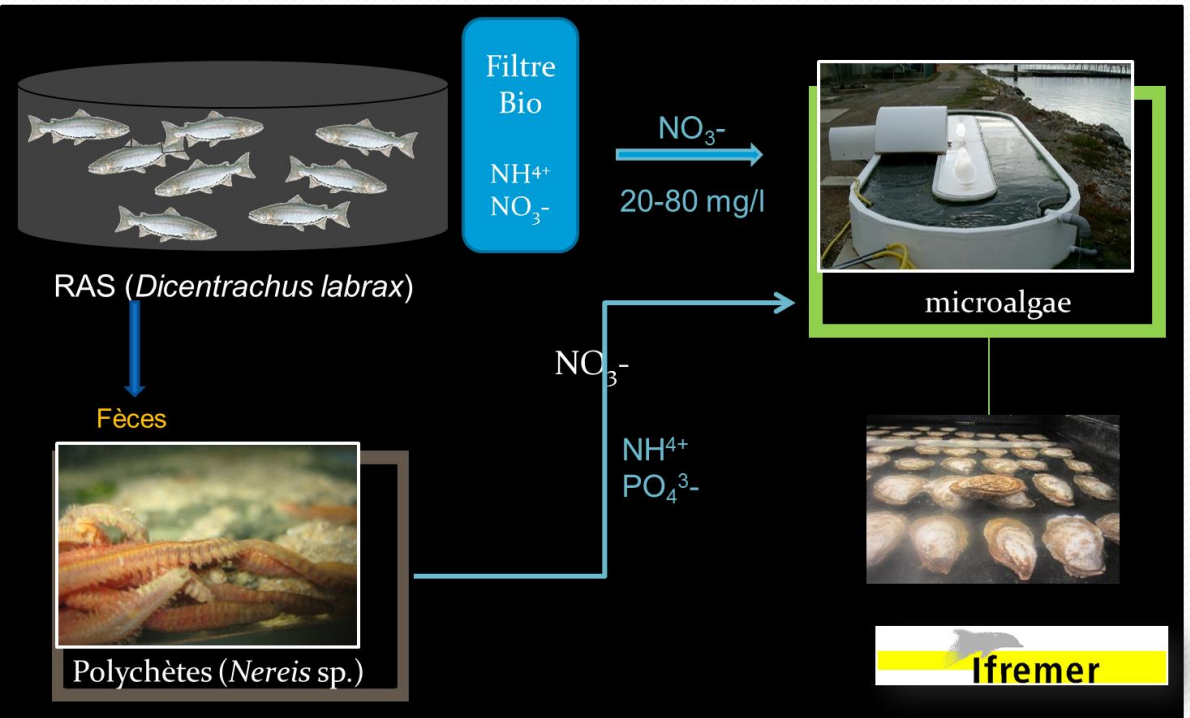
G1

Ifremer case study

France

Producing seabass in RAS, phytoplankton for oysters, and worms on sediments





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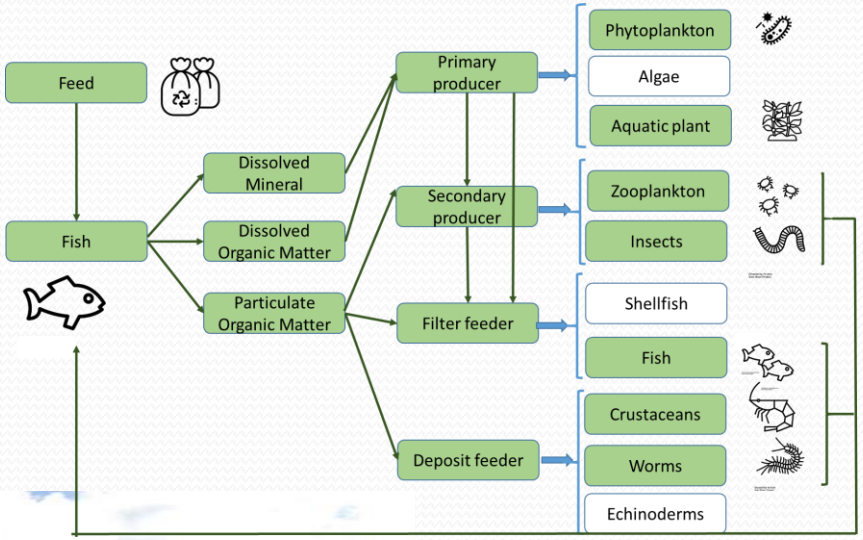
UDJG-Romfish **Case Study**

G 2

Romania

Cyprinid polyculture (common carp, silver carp, bighead carp, grass carp)



Fish stocking structure:

- Cyprinus carpio 74%
- Ctenopharingodon idella 14%
- Hypophthalmichthys molitrix 6%
- Hzpophthalmichthys nobilis 6%

- Cyprinus carpio 100%

Traditional system fish stocking structure:

- Cyprinus carpio 93%
- Ctenopharingodon idella 4%
- Hypophthalmichthys molitrix 1,5%
- Hzpophthalmichthys nobilis 1,5%

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Conclusion

- There is a large number of systems which can be considered as IMTA
- There is no one-size-fit-all solution; depending on the contexts (economic, environmental, social), the mix of species will be different
- The challenge is to propose operational principles and calculation tools to guide the IMTA conception
- The proof of concept has to be experienced more and more
- In a scientific point of view, the interspecific interactions and the complexity are challenges to face.
- Therefore the exchange of experience is a necessity

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Thank you for your attention

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